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Physical Activity through Sustainable Transport Approaches (PASTA): a study protocol for a multicentre project

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Abstract: INTRODUCTION: Only one-third of the European population meets the minimum recommended levels of physical activity (PA). Physical inactivity is a major risk factor for non-communicable diseases. Walking and cycling for transport (active mobility, AM) are well suited to provide regular PA. The European research project Physical Activity through Sustainable Transport Approaches (PASTA) pursues the following aims: (1) to investigate correlates and interrelations of AM, PA, air pollution and crash risk; (2) to evaluate the effectiveness of selected interventions to promote AM; (3) to improve health impact assessment (HIA) of AM; (4) to foster the exchange between the disciplines of public health and transport planning, and between research and practice. METHODS AND ANALYSIS: PASTA pursues a mixed-method and multilevel approach that is consistently applied in seven case study cities. Determinants of AM and the evaluation of measures to increase AM are investigated through a large scale longitudinal survey, with overall 14,000 respondents participating in Antwerp, Barcelona, London, Örebro, Rome, Vienna and Zurich. Contextual factors are systematically gathered in each city. PASTA generates empirical findings to improve HIA for AM, for example, with estimates of crash risks, factors on AM-PA substitution and carbon emissions savings from mode shifts. Findings from PASTA will inform WHO's online Health Economic Assessment Tool on the health benefits from cycling and/or walking. The study's wide scope, the combination of qualitative and quantitative methods and health and transport methods, the innovative survey design, the general and city-specific analyses, and the transdisciplinary composition of the consortium and the wider network of partners promise highly relevant insights for research and practice. ETHICS AND DISSEMINATION: Ethics approval has been obtained by the local ethics committees in the countries where the work is being conducted, and sent to the European Commission before the start of the survey. The PASTA website (http://www.pastaproject.eu) is at the core of all communication and dissemination activities.

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Physical Activity through Sustainable Transport Approaches (PASTA): a study protocol for a multicentre project

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ABSTRACT

Introduction: Only one-third of the European population meets the minimum recommended levels of physical activity (PA). Physical inactivity is a major risk factor for non-communicable diseases. Walking and cycling for transport (active mobility, AM) are well suited to provide regular PA. The European research project Physical Activity through Sustainable Transport Approaches (PASTA) pursues the following aims: (1) to investigate correlates and interrelations of AM, PA, air pollution and crash risk; (2) to evaluate the effectiveness of selected interventions to promote AM; (3) to improve health impact assessment (HIA) of AM; (4) to foster the exchange between the disciplines of public health and transport planning, and between research and practice.

Methods and analysis: PASTA pursues a mixed-method and multilevel approach that is consistently applied in seven case study cities. Determinants of AM and the evaluation of measures to increase AM are investigated through a large scale longitudinal survey, with overall 14 000 respondents participating in Antwerp, Barcelona, London, Örebro, Rome, Vienna and Zurich. Contextual factors are systematically gathered in each city. PASTA generates empirical findings to improve HIA for AM, for example, with estimates of crash risks, factors on AM-PA substitution and carbon emissions savings from mode shifts. Findings from PASTA will inform WHO's online Health Economic Assessment Tool on the health benefits from cycling and/or walking. The study's wide scope, the combination of qualitative and quantitative methods and health and transport methods, the innovative survey design, the general and city-specific analyses, and the transdisciplinary composition of the consortium and the wider network of partners promise highly relevant insights for research and practice.

Ethics and dissemination: Ethics approval has been obtained by the local ethics committees in the countries where the work is being conducted, and sent to the European Commission before the start of the survey. The PASTA website (http://www.pastaproject.eu) is at the core of all communication and dissemination activities.

Strengths and limitations of this study

- The study Physical Activity through Sustainable Transport Approaches (PASTA) pursues a mixed-method approach combining qualitative and quantitative methods from public health and transport research that have been developed and implemented by academicians and practitioners in a transdisciplinary setting.
- A large-scale quantitative survey on active mobility, physical activity, air pollution exposure and crash risk is carried out with an overall 14 000 participants in the PASTA case study cities Antwerp, Barcelona, London, Örebro, Rome, Vienna and Zurich.
- Longitudinal cohort data are collected for the detailed activity analyses and evaluation of selected policy measures and interventions in each PASTA case study city.
- The collected data directly feeds into the advancement of health impact assessment models and Health Economic Assessment Tool.
- The survey data may be biased due to opportunistic sampling and a web-based approach. Measures are in place to minimise any bias, including multiple recruitment approaches and analytical methods that take into account the recruitment methods.

INTRODUCTION

Reducing sedentary behaviour and increasing the level of physical activity (PA) in the population is a key goal of the EU Strategy on nutrition, overweight and obesity-related health issues.[1] In contrast to this policy goal, levels of PA are decreasing.[2 3] Only one-third of the European population is estimated to meet the minimum recommended levels of PA, which for adults correspond to at least 150 min of moderate-intensity aerobic PA throughout the week.[3–5] Globally, physical inactivity is the fourth leading risk factor for mortality and a major cause of non-communicable diseases.[5 6]

Walking and cycling for transport solely or in combination with public transport, also referred to as active mobility (AM), are well suited to provide regular PA. In contrast to sports or exercise, AM requires less time and motivation; it is convenient as a mode of transport and as a form of exercise, and it is economically affordable. Hence, AM has the potential to reach parts of the population who may be less receptive to appeals to participate in sports and exercise, or cannot afford doing these in terms of finance or time.[7] Especially for people with low PA, such as sedentary, obese and elderly people, it is easier to begin with AM as a moderate form of regular PA than with sports or other types of vigorous PA.[8]

Increasing AM not only supports public health objectives, but also serves goals in transport planning. The balanced and integrated development of all transport modes is a main characteristic of Sustainable Urban Mobility Plans (SUMP),[9] and a key goal in the strategic EU policy documents.[10–12] Increasing AM reduces the consumption of space for transport infrastructure, energy use, air pollution and noise, and improves overall quality of urban life.[13–16] However, to date, health aspects of AM are rarely considered in SUMPs. Practitioners in both public health and transport planning departments pursue opportunities to increase AM; however, they usually work in isolation, thus not benefiting from the large potential for synergy. Similarly, researchers in health and transport fields work on a better understanding of AM and its interrelation with PA, but again, systematic collaboration is rare.

Detailed studies on the inter-relationship between AM and PA are inadequate;[7] most studies are either conducted with methods based on public health that give an incomplete picture of AM, or with methods from transport research that give an incomplete picture of PA. Existing studies mainly apply cross-sectional designs which can neither capture the variability in walking and cycling, nor identify causal chains.

Factors determining AM behaviour include sociodemographic characteristics such as income or car ownership;[17–20] sociopsychological factors such as preferences, attitudes, habits or norms;[19] and sociogeographic factors such as climate and topography, the built environment or the transport system (Gerike R, Parkin J. Cycling futures: from research into practice. Farnham: Ashgate; forthcoming).[17 20–23] Cities with walking shares higher than 50% of all the trips such as Bilbao in Spain, and with cycling shares of up to 44%, such as in the Dutch cities of Eindhoven or Groningen, show that high shares of AM are feasible.[24] Parkin and Koorey[25 26] summarised the requirements for AM-friendly spatial settings with the principle density, destination accessibility, design, distance to public transport and diversity.[26 27] The perceived lack of traffic safety is an important deterrent for AM.[28–30] Despite a rapidly growing body of research, determinants of AM behaviour remain poorly understood, in particular with regard to their inter-relationship with PA.

Good practice collections for AM measures exist (eg, http://www.eltis.org/), but few rigorous evaluation studies are available[31 32] and public health aspects are rarely included in the evaluation of transport policies. Research projects, such as TAPAS,[29] SHAPES[33] or iConnect,[31–34] have addressed questions around AM and PA, as well as exposures to air pollution and crash risks resulting from AM. These provide important input, but more evaluation studies are needed.

In recent years, AM health impact assessments (HIA) and health impact modelling studies,[35 36] have received increasing attention in benefit-cost analysis and policy debates. Clear health effects have been demonstrated not only for overall PA, but also for PA from walking and cycling for transport.[30 37 38] Public health impacts of AM are dominated by benefits from PA, while health risks from air pollution and crashes are found to be relatively small.[30 35] Health risks from increased air pollution exposure are mainly studied in small sample sizes, with a limited geographical scope and scripted routes.[39 40] The empirical evidence on minor crashes and near misses, and on the risk exposure is limited.[41]

Many studies assessing health impacts of AM policies have applied the WHOs' Health Economic Assessment Tool (HEAT) for walking and cycling.[29 35 36 42–46] HEAT is a simple online tool that enables transport planners to value health benefits from regular walking or cycling.[47] While there has been a recent surge in the development of AM HIAs, overall these are characterised by inconsistent methodologies, the selective impact domains assessed, and the lack of robust input data.[30 35 36]

Against this background, the European research project Physical Activity through Sustainable Transport Approaches (PASTA) carried out from 2013 to 2017 pursues the following four main aims:

1. To investigate correlates and inter-relationship between AM, PA, air pollution and crash risk;
2. To evaluate the effectiveness of selected interventions and measures to promote AM so as to increase both AM and PA;
3. To improve the comprehensive HIA of AM;
4. To foster the exchange between the disciplines of public health and transport planning, as well as between research and practice.

Determinants of AM and the evaluation of measures to increase AM (hereafter referred to as AM measures) are investigated through a large-scale longitudinal survey conducted in seven PASTA case study cities with overall 14 000 respondents (Antwerp, Barcelona, London, Örebro, Rome, Vienna and Zurich). Contextual factors are systematically gathered for each city. PASTA generates empirical findings to inform quantitative HIA models, for example, with estimates of crash risks, factors on AM-PA substitution, and carbon emissions savings from shifts towards AM modes. Selected findings from PASTA will feed into the further development of HEAT.

As such, PASTA is a broadband research project on AM which spans various disciplines, research and practice, determinants and impacts, qualitative and quantitative methods, and other dimensions of relevance via a comprehensive approach to get a better understanding of the inter-relationship between travel behaviour and health. In a unique design, PASTA addresses the complexity of AM promotion by comprehensively tackling its determinants and impacts.

STUDY DESIGN

Overview

Figure 1 summarises the various parts of the PASTA project and its workflow. The project starts with a systematic review of the state-of-the-art of AM on which the subsequent work is built on, including:

- An in-depth assessment of AM enablers, planning practice, and demand at the city level in the seven PASTA cities;
- A web-based longitudinal study investigating determinants of AM, the inter-relationship between AM and PA, safety and air pollution exposure of AM, the effectiveness of selected AM measures;
- The advancement of HIA from AM.

Insights gained in these steps will feed into a compendium of good practice examples and recommendations for policies promoting PA through AM.

A unique feature of PASTA is its interdisciplinary and transdisciplinary approach.[48] PASTA addresses scientific questions at the interface of different disciplines with researchers from these disciplines jointly working by adopting an interdisciplinary approach. Beyond this, PASTA also works at the interface of scientific questions and societal problems. PASTA addresses the societal challenge of finding ways to effectively increase PA through AM, and the scientific challenge of enhancing the knowledge on AM and PA. The research approach to address these challenges has been jointly developed in PASTA by academic and non-academic partners working together in a transdisciplinary setting. This collaboration—throughout the study—ensures that the identified research questions (RQ) and methods are relevant for research and practice. It also ensures that innovations from research and practice feed into the PASTA project, and that the project results are fed back into the academic and non-academic professional communities. PASTA strives to create an impact beyond the scientific community not only through the involvement of stakeholders at every stage, but also by feeding into the continuous development process of HEAT.

In the subsequent sections, we will elaborate on each of the aforementioned aspects of PASTA.

State-of-the-art of AM research and practice

This first part of the PASTA project establishes the groundwork for all subsequent steps.

Academic and grey literature on determinants of AM and PA, policies and evaluation studies, and the usage of relevant terms in the public health and transport planning communities are reviewed through Rapid Evidence Assessment (REA).[49 50] REA, in contrast to systematic reviews (as applied for HIA, see section 2.5), commonly involves targeted searches of key literature without lengthy meta-analyses, and thus allows for rigorous reviews in a condensed timescale (3–6 months, not 1–2 years). The following steps were taken for the REA in this study: (1) definition of the RQ and search terms, (2) choice of key databases and sources by partners, (3) systematic literature search based on (1), (4) screening and selection of relevant studies, (5) narrative synthesis of included studies and (6) report production.[49] Clear RQ are paramount for successfully carrying out REA. This REA aimed at understanding the usage of relevant terms and to decipher the state-of-the-art for classifying AM measures, and for identifying AM and PA determinants.

On the basis of the REA review, a common glossary was developed that ensures mutual understanding throughout the project by harmonising terms of different disciplines. AM measures were classified along two dimensions: first, four transport mode characterisations—walking, cycling, public transport, multimodal trips—and second, four categories of policy measures—social environment, physical environment, regulation and strategic policies.[27] This scheme provides the basis for comprehensively covering all relevant transport modes and measures in the review, analysis, and good practice compilation. A set of qualitative and quantitative indicators was developed for the assessment of the state of AM demand, the state of practice of AM planning, and the contextual factors at the city level. A list of contacts in various institutions (referred to as Friends of PASTA) was compiled both for dissemination purposes as well as to seek stakeholder inputs throughout the project, for example, on good practices. The contacts originated not only from consortium partners' networks (eg, Polis, ICLEI, WHO), but also from the Advisory Board (AB) and external stakeholders, for example, from the PASTA cities.

Besides the critical review of published work, the methods used for these tasks include discussions with experts in the consortium and with members of the PASTA AB, and interviews and workshops with external stakeholders. The insights helped to gain support for all subsequent steps of the PASTA project, specifically for work done in the PASTA cities. The developed indicator system serves as the framework for the in-depth assessment of AM enablers, planning practice, and demand at

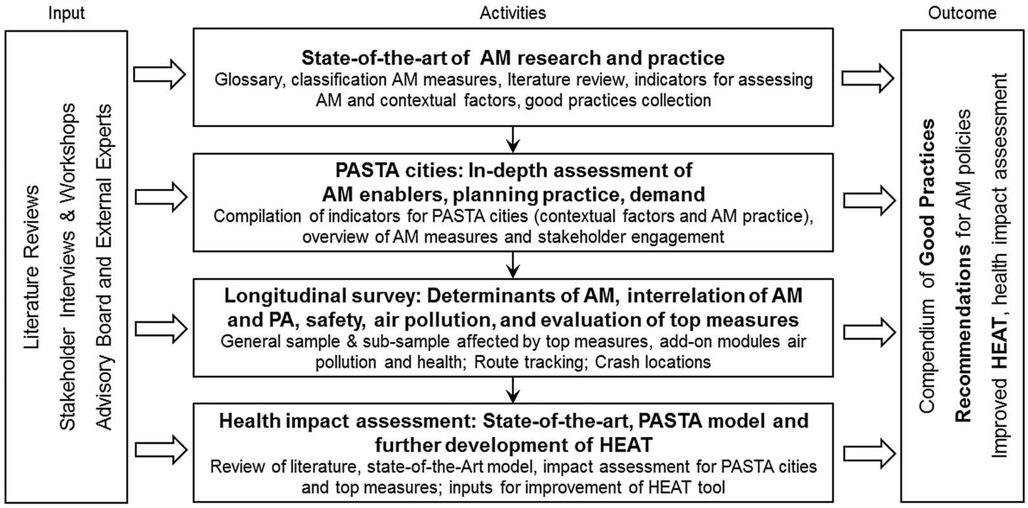

Figure 1 The PASTA approach (AM, active mobility, HEAT, Health Economic Assessment Tool; PA, physical activity; PASTA, Physical Activity through Sustainable Transport Approaches).

the city level as well as for the longitudinal study described in section 2.4.

PASTA case study cities: in-depth assessment of AM enablers, planning practice and demand

The insights gained from the above evidence review are complemented through in-depth analysis of the PASTA case study cities. Figure 2 gives an overview of the RQ and the analysis framework for the PASTA cities. Contextual factors, such as land use, the transport system, governance schemes or sociodemographic characteristics of the population, are referred to as 'enablers'. Enablers not only directly influence AM at the city level, but also facilitate the implementation of specific AM measures which again affect AM demand. PASTA analyses the effects of both the general city-specific contextual factors (enablers) and AM measures on AM demand.

The following tasks are completed for each of the PASTA cities in this part of the project:

1. AM indicators: Data are collected and analysed for the indicator set that has been developed in the first part of the project. Online supplementary appendix 1 shows an overview of the indicators.
2. AM measures: Information is gathered about planned and implemented measures, about successes and failures, about success factors and barriers, and about the institutional contexts. The individual measures cover all four categories, namely strategic policies such as SUMPs, changes to the physical environment (eg, specific infrastructure or services for walking and cycling), regulation (eg, speed limits, access restrictions), and interventions targeting the social environment (eg, AM campaigns).
3. Top measures: At least one so-called 'top measure' is selected for each PASTA city. These measures are evaluated with regard to the potential changes in AM behaviour within the longitudinal survey described in section 2.4. The following top measures will be evaluated:

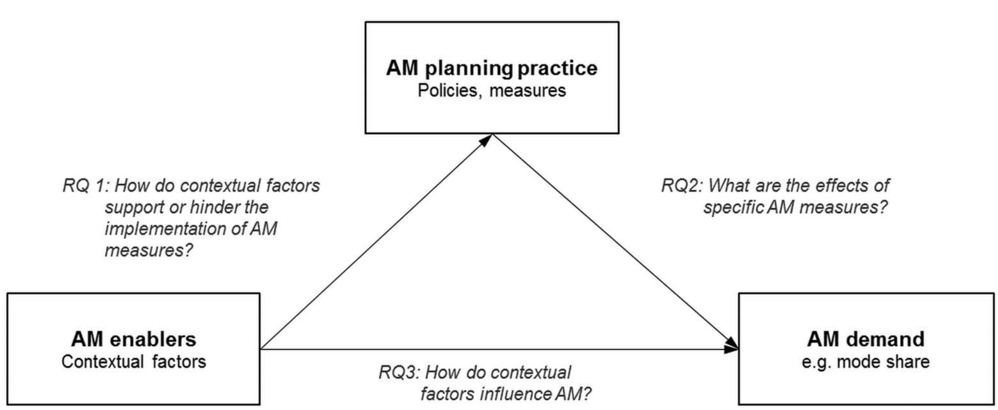

Figure 2 Research framework for the in-depth assessment of AM and the contextual factors at the city level for the PASTA case study cities (AM, active mobility, PASTA, Physical Activity through Sustainable Transport Approaches; RQ, research question).

- Physical environment: walking and cycling-oriented redevelopment of the 2012 Olympic park area in London; a cycle bridge on a bicycle commuter highway in Antwerp; installation of bicycle racks in Rome; implementation of car-free 'super islands' in Barcelona;
- Regulation: access restrictions for motorised vehicles to super islands in Barcelona;
- Social environment: personalised travel planning in Vienna; workplace campaigns accompanied by infrastructure upgrades (eg, leasing of electric assist bicycles, installation of bicycle racks) in Örebro;
- Subpopulations: in Zurich, users of electric assist bicycles and car-sharing members are studied to better understand the potential of such measures to promote sustainable transport.

4. Networking: PASTA approaches local stakeholders from public health, transport and urban planning by means of joint workshops to identify current institutional settings, funding schemes, policies and activities in both fields, and to systematically search for opportunities to strengthen the collaboration and bundle the efforts to increase AM.
5. Stakeholder needs for HIA: Local stakeholders are asked about their interest in and experience with HEAT, and their suggestions are taken to further develop this tool. This information feeds into the advancement of HEAT, and provides the basis for the application of the PASTA final HIA in the PASTA cities (see section 2.5).

Expert interviews and workshops are the main methods used for completing these tasks. Subsequent parts of PASTA benefit in several ways from this work with the PASTA cities; local stakeholders support recruitment for the longitudinal survey and give valuable inputs for the development of the HIA. Collected data and information is used to inform the data analysis of the longitudinal survey and to properly interpret those results. In addition, PASTA hopes to spark long-term collaboration of the involved local stakeholders.

Longitudinal survey: inter-relationship of AM and PA, safety, air pollution, and evaluation of the top measures

A major longitudinal survey of a targeted overall sample of 14 000 participants is being carried out in the seven PASTA cities. The survey platform was launched in November 2014; it is planned to be online until October 2016. Figure 3 gives an overview of the survey design which builds on the successful designs of the SHAPES,[33] TAPAS[29] and iConnect[31 32] projects.

Study population

The study targets the general population in the PASTA cities and aspires to represent a balance of all transport modes (private (car or motorcycle), public transport, walking, cycling). Participation in the study is open to people older than 16 or 18 years (depending on the local ethical approval) who either live, work, study or otherwise regularly spend time in these cities. Within the general sample, a subgroup of participants affected by the respective top measures and a corresponding control group are identified.

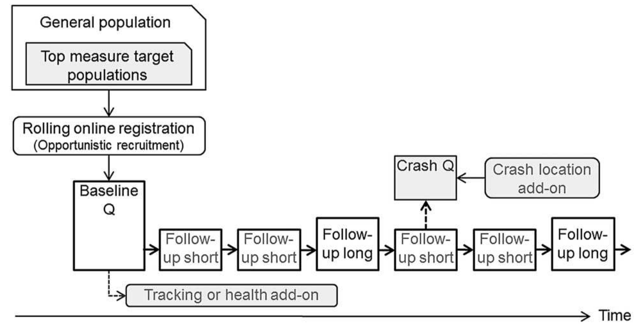

Figure 3 The PASTA longitudinal survey design (PASTA, Physical Activity through Sustainable Transport Approaches; Q, crash questionnaire).

Recruitment

A standardised recruitment strategy was developed for all cities based on an opportunistic approach (except Örebro). Recruitment began with a press release directly after the launching of the platform. Common promotional materials, including postcards and leaflets, are distributed, local stakeholders and target groups are contacted directly, and social media is extensively used throughout the enrolling recruitment process that runs over the whole survey period. Registration progress is continuously monitored through a dashboard which monitors participation by key variables which are compared against predefined sample composition targets, namely by gender, age groups and travel mode distribution.

Survey design and implementation

A longitudinal study design was chosen for the PASTA study for the following main reasons:

1. Repeated measures of AM and PA are warranted to derive robust estimates of long-term average behaviour since both AM and PA show substantial temporal variability.
2. To investigate how AM contributes to overall PA or how respondents may substitute increases in PA from AM with decreases in PA from other domains (eg, sports), repeated simultaneous assessments of AM and PA—within respondents—are necessary.
3. To assess crash risks of AM, longitudinal data is needed.
4. To evaluate how top measures affect AM (and overall PA), 'preimplementation/postimplementation assessments' are necessary.

To minimise the burden on participants and to limit logistic complexity, a web-based survey approach was chosen for the longitudinal study. Filter questions expose participants only to relevant questions. Map and routing tools support the identification of locations, for example, for home or the workplace. An attractive questionnaire design ensures high data quality and minimises the response burden. The entire survey procedure is automated—from the registration to reminders, and the assignments of participants to the general sample or the top measure groups.

Overview of the survey components

To accommodate the broad scope of topics relevant for the PASTA research objectives, and at the same time to keep participant burden bearable, a balance of contents for the individual questionnaires (minimising duration) and the follow-up frequency was chosen: The survey consists of a 'core module' that is filled out by all participants. The core module is complemented by the so-called 'add-on modules'. These are separate studies on 'time activity and route tracking', 'air pollution exposure and health' and crash location audits. We aim to recruit 120 or more participants from the core module for these 'add-on modules'.

Core module

Questionnaire sequence: Figure 3 shows the sequence of questionnaires for the core module. On online registration, participants are invited immediately to fill out the baseline questionnaire (BLQ). Regular follow-up questionnaires are issued every 13 days after the last questionnaire has been filled out. The sequence of follow-up questionnaires is a combination of two short follow-ups (FUS) and then one longer follow-up (FUL).

BLQ: All individual factors which are not expected to vary over time are collected in a fairly substantial BLQ (approximately 30 min to complete). Contents have been identified based on a conceptual model specifically developed for the PASTA project. The BLQ asks for sociodemographics, general AM and PA behaviour as well as perceptions, barriers, and attitudes. AM and PA are measured in parallel with the single item PA-question,[51] a slightly modified version of the Global Physical Activity Questionnaire (GPAQ) separating walking and cycling (http://www.who.int/chp/steps/GPAQ/), questions about the frequency of use of all transport modes and a 1-day travel diary adapted from the KONTIV design.[52 53]

FUS only contain a single question about mobility and PA in the last week, respectively, as well as a question about whether participants experienced a crash (ie, collision or fall) or 'near miss', that is, an unexpected event while walking or cycling which forces someone to take sudden evasive action, without which a crash would have occurred.

FUL are similar to the FUS and include, additionally, a 1-day travel diary and the GPAQ.

Crash questionnaire: Questions about 'near misses' and crashes are included in each core module questionnaire. If participants report a crash or a near miss, the questionnaire opens further and asks for detailed information as per the five categories of factors identified as:[54] human factors (eg, rider or pedestrian behaviour), vehicle-related factors (eg, type of bicycle, lights), infrastructure factors (eg, crossroad design), traffic conditions (eg, traffic density), and environmental factors (eg, weather).

Evaluation of top measures: For the evaluation of top measures, a subsample of participants in each city is divided into an affected and a control group. For these participants, the above described sequence of questionnaires is interrupted after two FUS by a hibernation period, resuming only after implementation of the measure.

Add-on modules

Tracking add-on: Data on active and motorised travel behavior, and PA will be collected with the help of the MOVES app (see https://www.moves-app.com/) and sent directly to the PASTA server. The combined analysis of data coming from the app and from the core questionnaires will allow for the validation of the core survey data.

Health add-on: Detailed data on AM and PA will be complemented in this add-on module by the assessment of health effects of travel behaviours. This assessment includes measurements of cardiovascular parameters such as heart rate variability, blood pressure and retinal vessel diameter (fundus photography), and respiratory parameters such as lung function (spirometry) and inflammation (exhaled nitrogene oxide).

Crash location add-on: Attributes of crash locations are reported in the crash questionnaire and will be compared to control locations randomly selected from trips on which crashes occurred, as done previously by.[55]

HIA: state-of-the-art, PASTA model and further development of HEAT

A main objective of PASTA is the improvement of HIA of AM based on the expertise within the PASTA consortium; existing research from projects such as SHAPES,[33] TAPAS,[45] iConnect,[31 32 56] ITHIM[46] and HEAT;[47 57] stakeholders from each PASTA city; and data collected in the longitudinal survey and its add-on modules.

To start with, a systematic review of HIA of AM was performed (see figure 1).[35] This review revealed the main health pathways and methods existing in HIA of AM (figure 4). This review also highlighted the weight of each health pathway associated with AM; it shows that PA is the main pathway to produce health benefits, outweighing any risks of air pollution exposure and crashes. Not only is the active traveller directly affected by a mode shift to AM, but also the general population profits from such a mode shift by overall motorised traffic volume reductions and associated exposure reductions of energy consumption, air pollution and noise emissions from (displaced) motorised travel.[16 58]

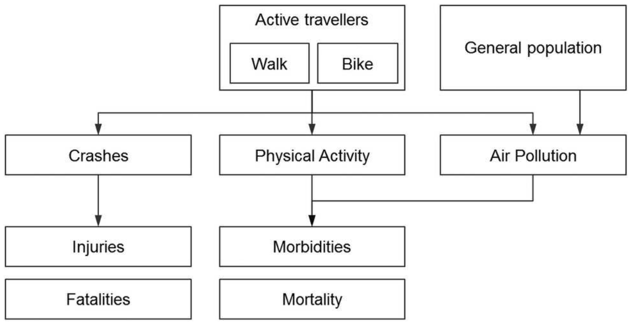

Figure 4 Framework for health impact assessment of active mobility.

The review also identified the main outcomes used to summarise and quantify the health impacts of AM (ie, mortality, morbidity, injuries, life expectancy, disabilities, work and school absences, and monetisation).

The workshops and interviews with stakeholders in the PASTA cities, described in section 2.3, served to identify the needs for assessment, the usefulness and feasibility of a HIA in the local context, and the availability of input data.

The longitudinal surveys and add-on modules, described in section 2.4, were designed to improve the quality and specificity of the input data necessary for quantitative HIA of AM. Examples of these data are (1) the levels and distributions of PA from walking and cycling; (2) the association between AM and total PA, with special interest in the PA substitution effect; (3) the AM associated crash risk and (4) varying air pollution exposure levels of different modes of transport.

The enhanced HIA model for AM will update methods and dose–response functions for PA (non-linear, with greatest health benefits occurring for sedentary people becoming moderately active[59]) and AP; include an assessment for travellers (PA, air pollution and crashes) in combination to general population exposure (AP and noise); and integrate new health outcomes.

The PASTA HIA model will be applied prospectively to the top measures proposed by each city to assess and quantify expected health impacts and to inform policymakers on overall effectiveness of the top measures.

Finally, this work will feed into updates of HEAT, that is, include additional health outcomes (morbidities), possible substitution effects between AM and PA, implications of crash risk, air pollution exposure, fuel savings and carbon emissions reductions, and alternative economic valuations. New modules and functionalities of HEAT will be designed with the specific aim of being user friendly and tailored to the target audience of users (eg, urban and transport planners) who do not necessarily possess advanced expertise in epidemiology, modelling and/or economics.

Dissemination

The core element of all communication and dissemination activities within this study is the website where information about all activities is constantly updated, see http://www.pastaproject.eu. The dissemination strategy aims at getting relevant stakeholders involved; disseminating good practices and recommendations for promoting AM; facilitating the take up of the developed HIA tools and HEAT; stimulating behavioural changes among end users; and supporting recruitment for the longitudinal survey. Dissemination activities are carried out by all partners. These range from leaflets, press releases, activities in social media to the organisation of and participation in various events such as the Transport & Health Conference 2015 (see http://www.tphlink.com/2015-transport–health-conference.html), the IATBR conference 2015 (see http://www.iatbr2015.org.uk/), the Walk21 conference 2015 (see http://walk21vienna.com/), and the Polis annual conference 2015 (see http://www.pastaproject.eu/news-items/events/). The advanced HEAT, together with a compendium on good practices for AM measures, will be made available for free online and specifically distributed to local/regional/national governments, health and transport authorities at all levels, relevant experts and non-governmental organisations.

SUMMARY OF LIMITATIONS OF CURRENT WORK ON AM AND PA AND OF THE PASTA STUDY'S CONTRIBUTIONS

Table 1 summarises the main contributions that PASTA adds to previous work. The study pursues an innovative transdisciplinary approach by combining cutting edge methods from public health and transport research. Qualitative and quantitative methods from both disciplines are systematically combined in order to gain insights on the determinants of AM and PA, their interrelationship, and the effectiveness of AM measures. On the basis of the empirical work in PASTA, HIA are advanced and the process includes updating HEAT. PASTA involves stakeholders from research and practice, and from public health and transport planning to inform the project's research efforts. Perhaps the most important and unique contribution of PASTA is the combination of these various approaches, thus addressing the real world complexities of AM promotion in a unified framework.

CONCLUSIONS

PASTA is a comprehensive research project that encompasses current RQ on AM that range from understanding determinants and measures impacting AM to include a more in-depth understanding of the interrelationship between AM and overall PA, and culminates in the improvement of HIA. Its wide scope and the combination of qualitative and quantitative methods as well as health and transport planning methods, the innovative survey design and data collection efforts, the general as well as city-specific reviews and analyses, and the transdisciplinary composition of the consortium and the wider network of partners all promise highly relevant insights for research and practice. With HEAT and a

Table 1 Limitations of current work on AM and PA and work undertaken by PASTA to address these

Limitations of current work on AM and PA	Contribution of PASTA project
AM enablers, planning practice and demand at city level	
Few multimethod and multilevel studies	Systematic combination of qualitative and quantitative methods for the PASTA case study cities, with major longitudinal web-based survey, expert interviews, desktop research about city-specific material, stakeholder workshops, compilation of city indicators on AM, PA, contextual factors
Determinants of AM behaviour at the individual level	
The relative importance of various determinants of individual AM behaviour is poorly understood, few studies comprehensively assess the wide range of factors which affect AM and PA	Data collection and analysis based on a broad conceptual framework reflecting geographical, utilitarian and psychological factors, as well as data hierarchies (aggregation levels)
Predominantly cross-sectional approaches	Longitudinal approach, online survey with long baseline questionnaire and a frequent short follow-ups, continuous recruitment over 2 years
Often small sample sizes	Targeted sample size of 14 000 respondents across seven cities, number of submitted questionnaires per city >5,000
Few studies investigate AM consistently across different settings with varying mode shares of AM, resulting in insufficient insights on the role of cultural differences and values	Comparable study design in the seven PASTA cities: Antwerp, Barcelona, London, Örebro, Rom, Vienna and Zurich
Inter-relationship between AM and PA behaviour at the individual level	
Current studies are conducted either with methods from public health (oversimplified picture of travel behaviour, no motorised trips) or from transport research (no non-travel PA, proportion of recreational PA in leisure trips unclear)	Interdisciplinary approach, systematic combination of methods from public health (modified GPAQ) and transport research (travel diary) for comprehensive data collection on AM and PA, innovative web-based data collection
Few validation efforts for self-reported estimates	Validation of data from the PASTA core survey for subsamples by accelerometers, smartphone tracking apps, GPS loggers
Substitution behaviour is poorly understood	Multiple, repeated parallel assessments of AM and PA allow for quantification of substitution behaviour in the short and longer term
Contextual factors often not considered in quantitative studies	Systematic compilation of indicators of AM and PA, of information on the contextual factors through stakeholder workshops and expert interviews for the PASTA cities
Evidence for effectiveness of AM measures	
Few systematic collection of measures supporting AM and PA	Systematic review of state-of-the-art AM measures and their assessments in the literature, the PASTA cities and additional cities (eg, friends of PASTA network)
Few studies exist on the evaluation of AM measures	Evaluation of top measures in PASTA cities: infrastructure enhancements (eg, cycle bridge, cycle super highways, leeway, bicycle racks), traffic organisation (ban of vehicles in selected areas), campaigning (workplace mobility management, personalised travel planning)
Few evaluation studies with control group designs	Control groups for all top measures, using of innovative approaches for the assignment of respondents to the affected or control group with the help of GIS-buffers or questions in the baseline questionnaire
High variability in AM leads to failure in evaluation studies	Longitudinal design with repeated measures, large sample sizes
Insufficient knowledge on the contribution of changes in perceived vs objectively measured environment attributes on behaviour change, on pathways, and relative influence	Comprehensive measurement of perceived and objectively measured determinants of AM
Determinants of crash risks	
Under-reporting of (minor) AM crashes and near misses	Integration of questions about AM crashes and near misses into the core module of the PASTA longitudinal survey
Few reliable numbers exist on the relative crash and crash risks of walking and cycling	Major longitudinal study collecting data about crashes and near misses expressed per kilometre or time cycled or walked, for different person groups and contextual measures

Continued

Table 1 Continued

Limitations of current work on AM and PA	Contribution of PASTA project
Few on-site visits of crash locations	Locations of reported crashes and near misses are examined in order to collect detailed information for use as the basis for computing crash risks for AM
Air pollution exposure	
Lack of real-life studies on combined health effects of air pollution and PA—especially multicentre studies are missing	In three cities, exposure to air pollution and PA is assessed under real-life conditions. A multitude of non-invasive health biomarkers are repeatedly measured in 120 volunteers
Air pollution exposure while travelling is largely unknown or ignored by using fixed monitoring stations	Mobile sensors are used for air pollution, PA and travel behaviour. Not only exposure, but also inhaled dose is taken into account (especially relevant for AM)
HIA	
Lack of stakeholder involvement in studies quantifying health impacts of AM	Performed workshops and interviews with stakeholders in each of the seven PASTA cities
Inconsistent use of methodologies and outcomes	Develop a systematic review of the state-of-the-art on the HIA of AM, and integrate the good practices on risk assessment and HIA for multiple pathways and health outcomes
Lack of local and specific input data for modelling the health impacts. In special data on PA levels and distribution for walking and cycling, substitution effect, air pollution exposure, and crash risk in each city	Design of a longitudinal survey and add-on modules to collect data on PA, air pollution exposure, crashes
Lack of translational science	Update HEAT for cycling and walking, designed with the specific aim of being user friendly and tailored to the target audience of users (ie, urban and transport planners) who do not necessarily possess advanced expertise in epidemiology, modelling and/or economics, which is normally required for the implementation of a comprehensive HIA
Apply the PASTA model in the local context to evaluate expected health impacts of top measures in order to inform policymakers on effectiveness of measures and provide recommendations on how to maximise health benefits	
Lack of understanding of co-benefits of AM beyond personal health, for example, economic effects, reductions in carbon emissions	Extend economic and environmental co-benefit assessment, for example, incorporate empirical findings from PASTA on carbon emissions savings from (displaced) motorised traffic into HIA model
Transdisciplinary approach	
Few collaborations between public health and transport professionals	Systematic collaboration of professionals in public health and transport planning
Few exchanges between research and practice	Integration of stakeholders from research and practice during all phases of the project, beginning from the development of the research questions and methods to the broad dissemination of results through scientific and non-scientific communication channels
Few considerations of health arguments in transport policies for promoting AM	Compendium of good practices and recommendations for integrating public health aspects into urban planning and SUMPs

AM, active mobility; GPAQ, Global Physical Activity Questionnaire; HEAT, Health Economic Assessment Tool; HIA, health impact assessment; PA, physical activity; PASTA, Physical Activity through Sustainable Transport Approaches; SUMPs, Sustainable Urban Mobility Plans.

compendium of good practices, significant PASTA findings will materialise in the form of two products tailored for a broad audience of practitioners and beyond.

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Ethics approval Ethics approval was obtained for all aspects of the study by the local ethics committees in the countries where the work was conducted, and sent to the European Commission before the start of the survey/study. The local ethics committees are listed as follows:

- Ethics board of the University hospital of Antwerp (Belgium) on 20 October 2014
- Clinical Research Ethics Committee of the Municipal Health Care (Barcelona, Spain) on 1 October 2014
- Imperial College Research Ethics Committee (London, UK) on 20 November 2014
- Regional ethical board, situated at the University of Lund (Örebro, Sweden) on 9 April 2015
- RSM—Roma Servizi per la Mobilità and the Air quality Commission of Roma Capitale Administration (Rome, Italy) on 24 November 2014
- The Austrian Data Processing Register (Vienna, Austria) on 26 September 2014
- Kantonale Ethikkommission Zürich (Switzerland) on 28 October 2014

Various dissemination activities are carried out throughout the project, see http://www.pastaproject.eu

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Physical Activity through Sustainable Transport Approaches (PASTA): a study protocol for a multicentre project

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Notes